

Patent claims

1. Rotary indexing machine (10) having a fixed machine frame, which is designed for holding a multiplicity of machining units (66) and comprises at least one support (70), and a rotary table (40) rotatable relative to the machine frame about a vertical indexing axis (12), characterized in that the support (70), to create free space for the machining of a workpiece to be arranged on the rotary table (40), is designed for the lateral attachment of at least one machining unit (66).
2. Rotary indexing machine (10) according to Claim 1, characterized by a design of the support (70) and of the machining unit (66) such that the machining unit (66) having a work spindle can be laterally attached to the support (70) alternatively in a first position with essentially horizontally arranged work spindle or in a second position with essentially vertically arranged work spindle.
3. Rotary indexing machine (10) according to Claim 1 or 2, characterized by a design of the support (70) such that, on one side of the support (70), two machining units (66), each with a work spindle provided with a tool, can be attached to the support (70) one above the other in such a way that the two tools can be brought into engagement with the workpiece simultaneously, the workpiece being clamped in a clamping device (56) arranged on the rotary table (40).
4. Rotary indexing machine according to Claim 3, characterized by a design of the support (70) and of the two machining units (66), attached to one side of the support (70), such that the work spindles of the two machining units (66) are each movable independently of one another with three translatory degrees of freedom.
5. Rotary indexing machine (10) according to one of Claims 1 to 4, characterized by a design of the support

(70) such that it has two sides, to each of which at least one machining unit (66) can be attached.

6. Rotary indexing machine (10) according to Claim 5, characterized in that, to create additional free space for the machining of the workpiece to be arranged on the rotary table (40), the two sides are arranged in a wedge shape on an essentially vertically extending section (72) of the support (70) in such a way that the tip of the wedge is directed in the radial direction toward the indexing axis (12).

7. Rotary indexing machine (10) according to Claim 6, characterized in that the tip of the wedge encloses an angle which is less than approximately 45 degrees.

8. Rotary indexing machine (10), in particular according to one of Claims 1 to 7, having a fixed base unit (30), a rotary table (40) which is rotatable relative to the base unit (30) about a vertical indexing axis (12) and on which a satellite (50) provided with at least one clamping device (56) for clamping a workpiece is arranged so as to be rotatable about a vertical satellite rotation axis (55) relative to the rotary table (40), and a satellite drive device (52, 53, 54), which is arranged on the rotary table (40), is moved along with the latter and permits rotation of the satellite (50) about the satellite rotation axis (55) during the rotation of the rotary table (40) about the indexing axis (12), characterized in that the satellite (50) has a shaft (51), which leads through the rotary table (40), is rotatable relative to the rotary table (40) about the satellite rotation axis (55) and is connected to the satellite (50) in a rotationally locked manner and on whose end face facing the base unit (30) a Hirth serration system (58) is arranged, and in that an indexing device (60) is arranged on the base unit (30), the indexing device (60) having a column or annular disk (61), which is linearly displaceable parallel to the indexing axis (12) and on whose end face facing the rotary table (40) a Hirth serration system (62) corresponding to the

Hirth serration system (58) on the satellite shaft (51) is arranged, the arrangement being such that, to index the satellite (50), the Hirth serration system (62) of the indexing device (60) can be displaced linearly in the direction of the rotary table (40) in order to mesh with the Hirth serration system (58) of the satellite (50) and thereby effect the indexing of the satellite (50), and, to release the indexing, the Hirth serration system (62) of the indexing device (60) can be displaced linearly in the direction away from the rotary table (40).

9. Rotary indexing machine (10), in particular according to one of Claims 1 to 8, having a fixed base unit (30) and a rotary table (40) rotatable relative to the base unit (30) about a vertical indexing axis (12), characterized in that the drive means (46) for driving the rotary table (40) comprises an electrical machine (46) designed as a directly driven rotary spindle (46) and having a stator (42) which is firmly connected to the base unit (30) and a rotor (43) which is firmly connected to the rotary table (40).

10. Rotary indexing machine (10) according to Claim 9, characterized in that the rotary indexing machine (10) also comprises a measuring device for the exact measurement of the position and the speed of the rotor (43) relative to the stator (42) and a circuit arrangement, comprising a cascade controller with feedback of the speed and position, for controlling the directly driven rotary spindle (46).

11. Method of constructing a rotary indexing machine (10) according to Claim 10, characterized in that the method comprises a step based on the harmonic balance method for optimizing the system parameters of the directly driven rotary spindle (46) and of the circuit arrangement for controlling the directly driven rotary spindle (46).

12. Rotary indexing machine, in particular according to one of Claims 1 to 11, having a fixed pedestal (120) and a rotary table (140) rotatable relative to the

pedestal about a vertical indexing axis (112), characterized in that a chip conveying device (193, 194, 198) is arranged below the rotary table for the disposal of chips and is designed for conveying the
5 chips around the pedestal (120) and/or around a fixed base unit (130) of the rotary indexing machine up to an outlet opening.

13. Rotary indexing machine according to Claim 12, characterized in that a fixed collecting device (199)
10 for collecting chips, coolants and/or lubricants is formed and arranged in a funnel shape below the rotary table (140) in such a way that the chips are conveyed to the chip conveying device (193, 194, 198) essentially by the force of gravity.